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INTERNATIONAL BULLETIN OF BACTERIOLOGICAL NOMENCLATURE AND TAXONOMY

Volume 7 July 15, 1957 No. 3

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Volume 7 July 15, 1957 No. 3

THE STATUS OF THE GENUS MICROCOCCUS COHN, 1872[1]

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Several recent authors have questioned the status of the genus Micrococcus as proposed by Cohn, 1872 (Heft 2, page 151). A careful review of the proposals that have been made regarding the nature of the genus Micrococcus is given by Buchanan (General Systematic Bacteriology, 1925, pp. 373-377).

The first paragraph of this review reads as follows, and is quoted verbatim because it gives an excellent summary of the way in which the name Micrococcus came into bacteriological literature: "Micrococcus. This name was first used by Hallier (1866) to indicate a growth form of a mold in accordance with his conception of pleomorphism. He did not use the name in a generic sense, and the genus should therefore not be ascribed to him, as has frequently been done by various authors. Cohn (1872, p. 151) adopted the name and defined it as a genus containing very small spherical or oval organisms, with colorless or light colored cells, without motility, remaining after cell division united into rosary-like threads, many-celled families or slimy masses. The first organism to which the name was given was Micrococcus prodigiosus (Ehr.) Cohn. This organism is now generally removed from this genus

[1]Journal Paper No. 1068 New York State Agricultural Experiment Station, Cornell University, February 1957.
[2]Deceased February 10, 1956.

because of its shape. The next organism was named M. luteus (Schroet.) Cohn. This form may well be considered the type of the genus as it has been adequately described."

Later Cohn (1875) split his former genus into two, creating the new genus Streptococcus Cohn. His revised definition of Micrococcus included those organisms with "spherical cells, amorphous, cells without phycochrome, very small."

It will be noted that during the period between 1872 and the time when liquefiable solid culture media came into use, no one questioned the inclusion in Cohn's emended genus Micrococcus of certain species that were later shown to have the ability to grow out into distinct rods. Two of these species were Cohn's so-called Micrococcus prodigiosus (presumably Serratia marcescens Bizio, 1823), and Micrococcus violaceus (presumably Chromobacterium violaceum Bergonzini, 1881), and other species that would have been recognized as rods if studied by modern methods. Cohn and Schroeter studied their organisms as grown on slices of cooked potato and on coagulated egg albumen. Colonies appeared on these solid culture media when they were exposed to air. Many of the colonies on potato and egg white media were mixed cultures but some were pure cultures. These were preserved in the early days in broth cultures.

It was Zopf (1885, page 51) who divided the cocci of Cohn into the genera Micrococcus, Streptococcus, Merismopedia, Ascococcus and Sarcina. Zopf defined Micrococcus as made up of cocci not in packets and as producing large quantities of capsular material. He speaks of cells being irregularly arranged in grape-like clusters. Zopf regarded the generic name Staphylococcus Rosenbach, 1884, as a synonym of Cohn's Micrococcus, 1872.

Zopf places 14 species in the genus Micrococcus, several of which would be accepted today as true micrococci; but he, like Cohn, still included certain organisms that are now regarded as short rods. The elimination of these short rod forms did not really take place before Migula emended the description of Micrococcus in such a way as to eliminate motile forms, and to limit the genus to organisms where the individual cells occurred as spheres, these being frequently united into twos and fours, division taking place in two perpendicular planes.

Throughout all of this period one of the species described by Cohn in 1872 was retained in the genus by all authors. This species, which was a true Micrococcus, was named Micrococcus luteus by Cohn. Breed (Internatl. Bull. Bact. Nomen. and Taxon., 1952, 2:85-88) points out that the description of this species given by Cohn and Schroeter is adequate to permit rather positive identification of this species. Following sound principles governing the selection of type species for a genus, Buchanan (1916) designated this species as the type species of the genus Micrococcus Cohn. This designation of Micrococcus luteus as type species fixes the nature of the genus and has been accepted by later authors, such as Winslow et al., 1917, and in various editions of Bergey's Manual between 1923 and 1948.

It is not surprising that under these circumstances authors that are unfamiliar with the principles followed by taxonomists in fixing the nature of genera by the use of the type species concept should have found this history so confusing that they have contended that the genus Micrococcus Cohn, 1872, should be regarded as so poorly described as to be unrecognizable.

It is therefore recommended that the Judicial Commission on Bacteriological Nomenclature review the status of the genus Micrococcus Cohn, 1872, type species Micrococcus luteus (Schroeter) Cohn. Breed 1952 recommended that culture No. 398 of the American Type Culture Collection be accepted as a type culture for the genus Micrococcus but Gibson (Internatl. Bull. Bact. Nomen. and Tax., 1953, 3:129-133) has questioned the selection of this culture on the ground that he was unable to grow this organism in Cohn's ammonium tartrate solution. Recently a review has been made of the original description of the growth of Micrococcus luteus in Cohn's ammonium tartrate solution, whereupon it was discovered that Cohn reports that no growth took place in this solution for six weeks, and then only a slight turbidity appeared near the surface. Cultures have recently been made (1955) in Cohn's ammonium tartrate solution and held for six weeks, whereupon growth took place just as described by Cohn. On repeated transfers of these organisms, first to slants to make sure that the growth was due to the organism originally inoculated into the tube and then into other tubes of tartrate solution, cultures of No. 398 have grown in Cohn's ammonium tartrate solution

within ten days to two weeks. This culture appears to be a typical culture of Micrococcus luteus.

In light of these results it is recommended that culture No. 398, Micrococcus luteus of the American Type Culture Collection be designated as the type culture for the genus Micrococcus.

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A SIMPLIFIED SYSTEM OF BACTERIAL CLASSIFICATION

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INTRODUCTION

Among the contemporary systems of classification of bacteria the best known and most complete are those of the Bergey's Manual (1948), of Krassilnikov (1949) and of Prévot (1948). Each has its advantages and disadvantages. Each was prepared by specialists--microbiologists with special training and interests in single branches of microbiology. We need biologists--microbiologists who are able to introduce better biologic concepts into the development of classification of bacteria (Cowan, 1955).

The first system, that of the Bergey's Manual (1948), is the most complete but it is also the most complicated. Certain of the specialized groups of bacteria are much split up, not on the basis of their genuine biological characteristics, but in the majority of cases on the basis of particular and unstable characters, such as the ability to produce disease in certain plant hosts. The basis of this system is an idealistic notion of species as a taxonomic concept, not the realities as found in nature. From this concept has come the recognition of a large number of "split" species, which do not in reality correspond to the biological species of microorganisms to be found in nature. The essential characteristics of this system is the recognition of discontinuities, of static states and the consequent creation of a series of "mechanical keys" for the practical determination of the specialized groups of bacteria. It would seem that this system cannot serve as the basis for making a contemporary system for classifying the bacteria.

The second system, that of Krassilnikov (1949) is quite different, even though it is concerned primarily with the non-pathogenic bacteria significant in general, agricultural, and technological bacteriology. This classification is based on the materialistic concept of a species as a reality in nature, as a definite stage in the development of living

matter, as a link in the chain of evolution of living things. These species are based on the complex of the more stable biological characteristics, and thus keep up the dynamics of development of organisms in nature. Since species in nature include varieties (subspecies), biotypes, ecotypes and strains, in this system each species of microorganism is described in accordance with the main characteristics with a range of biotypes and strains which may be differentiated. This corresponds best with the natural state of the organism, it is nearest to the natural evolutionary classification of microorganisms, and may well therefore serve as the basis for making a contemporary classification.

The third system, that of Prévot (1948) is based on the ideas of the creators of the first system, with adoption and special stressing of some of its negative characteristics. The criteria for separation of the several categories are fixed upon a still lower level, there is no justification for the separation on the basis of such trivial characters. Moreover, the nomenclature is even more complex and unjustified than in the system of the Bergey's Manual. It is not surprising, therefore, that one finds a family named Innominaceae with a genus Innominatus.

OUR SYSTEM

As a result, we have suggested (Tešić, 1956) a new and simpler classification of bacteria based in essentials upon the system of Krassilnikov with certain changes made primarily for didactic reasons. We accept fully the principles upon which this system is based by the Russian bacteriologist. We have attempted to apply it more literally in some places. We have endeavored to simplify and make more uniform the nomenclature, this for the didactic requirements in the teaching of general, agricultural and technical microbiology.

Class SCHIZOMYCETES Nägeli, 1857--BACTERIA

Order I. EUBACTERIALES Buchanan, 1917--TRUE BACTERIA

Family I. COCCACEAE Zopf, 1889--SPHERICAL BACTERIA

Genus I. Micrococcus Migula, 1900. Single, non-motile spherical bacteria
Genus II. Planococcus Migula, 1900. Single, motile, spherical bacteria
Genus III. Nitrosococcus Winogradsky, 1892. Spherical bacteria of nitritation
Genus IV. Streptococcus Billroth, 1874. Spherical bacteria in chains
Genus V. Sarcina Goodsir, 1842. Spherical, non-motile bacteria in packets
Genus VI. Planosarcina Migula, 1900. Spherical, motile bacteria in packets

Family II. MYCOBACTERIACEAE Chester, 1901--ROD-SHAPED, NON-MOTILE BACTERIA

Genus I. Mycobacterium Lehmann et Neumann, 1896. Acid-fast bacteria
Genus II. Corynebacterium Lehmann et Neumann, 1896. Gram positive bacteria
Genus III. Aplanobacterium[1] Smith, 1905. Gram negative bacteria
Genus IV. Propionibacterium Orla-Jensen, 1909. Propionic bacteria
Genus V. Lactobacterium Beijerinck, 1900. Lactic bacteria

Family III. PSEUDOMONADACEAE Winslow et al., 1917--ROD-SHAPED, MOTILE (POLAR FLAGELLA) BACTERIA

Genus I. Pseudomonas Migula, 1900. Nonpigmented and fluorescent bacteria
Genus II. Chromopseudomonas Tešić, 1956. Pigmented, polar-flagellated bacteria
Genus III. Rhodopseudomonas Kluyver et van Niel, 1937. Purple polar-flagellated bacteria

[1] Editorial Note. The generic name proposed by Smith was Aplanobacter, not Aplanobacterium. The latter is a nomen novum.

Genus IV. Rhizomonas Orla-Jensen, 1909. Root nodule bacteria
Genus V. Nitrosomonas Winogradsky, 1892. Polar-flagellated bacteria producing nitrate
Genus VI. Acetomonas Orla-Jensen, 1909. Vinegar-producing bacteria

Family IV. BACTERIACEAE Cohn, 1872--ROD-SHAPED, MOTILE (PERITRICHOUS) BACTERIA
Genus I. Bacterium[1] Ehrenberg, 1828. Colorless, rod-shaped, peritrichous bacteria
Genus II. Chromobacterium Bergonzini, 1881. Pigmented, rod-shaped, peritrichous bacteria
Genus III. Chlorobacterium Lauterborn, 1913. Green bacteria
Genus IV. Photobacterium Beijerinck, 1889. Luminous bacteria
Genus V. Azotobacterium[2] Beijerinck, 1901. Asymbiotic nitrogen-fixing bacteria
Genus VI. Thiobacterium Lehmann et Neumann, 1927. Sulfur-oxidizing bacteria
Genus VII. Nitrobacterium[3] Winogradsky, 1892. Nitrite-oxidizing bacteria

Family V. SPIRILLACEAE Migula, 1894--SPIRAL-SHAPED BACTERIA
Genus I. Vibrio Müller, 1773. Rods, curved, bacteria
Genus II. Cellvibrio Winogradsky, 1927. Rods, curved, cellulolytic bacteria
Genus III. Spirillum Ehrenberg, 1830. Spiral, colorless bacteria
Genus IV. Rhodospirillum Molisch, 1907. Spiral purple bacteria

[1]Editorial Note. The generic name Bacterium was made a nomen rejiciendum by action of the Rome Microbiological Congress (1953).

[2]Editorial Note. The generic name proposed by Beijerinck was Azotobacter and not Azotobacterium. The latter is a nomen novum.

[3]Editorial Note. The generic name proposed by Winogradsky was Nitrobacter, not Nitrobacterium. The latter is a nomen novum.

Family VI. BACILLACEAE Fischer, 1895--ROD-SHAPED SPOROGENIC BACTERIA
- Genus I. Bacillus Cohn, 1872. Spores central and cells cylindrical
- Genus II. Clostridium Prazmowski, 1880. Spores central and cells swollen
- Genus III. Plectridium Fischer, 1895. Spores terminal and cells cylindrical

Order II. ACTINOMYCETALES Buchanan, 1917--ACTINOMYCETES

Family I. ACTINOMYCETACEAE Buchanan, 1918--ACTINOMYCETES WITH CHAINS OF CONIDIA
- Genus I. Actinomyces Harz, 1877. Typical or true actinomycetes
- Genus II. Proactinomyces Jensen, 1934. Primitive actinomycetes

Family II. MICROMONOSPORACEAE Krassilnikov, 1941--ACTINOMYCETES WITH SINGLE CONIDIA
- Genus I. Micromonospora Oerskov, 1923. Actinomycetes with single conidia

Order III. MYXOBACTERIALES Jahn, 1911--SLIME BACTERIA

Family I. PROMYXOBACTERIACEAE Imshenetzki, 1945--PRIMITIVE SLIME BACTERIA
- Genus I. Promyxobacterium Imshenetzki, 1945. Slime bacteria with rounded ends
- Genus II. Cytophaga Winogradsky, 1929. Slime bacteria with pointed ends
- Genus III. Sporocytophaga Stanier, 1940. Sporogenic slime bacteria with pointed ends

Family II. MYXOBACTERIACEAE Thaxter, 1892--ROD-SHAPED SLIME BACTERIA
- Genus I. Polyangium Link, 1809. Slime bacteria with many cysts
- Genus II. Sorangium Jahn, 1924. Slime bacteria with acervate cysts
- Genus III. Chondromyces Berkeley et Curtis, 1857. Slime bacteria with cystophores

Family III. MYXOCOCCACEAE Jahn, 1924--SPHERICAL SLIME BACTERIA
- Genus I. Angiococcus Jahn, 1924. Slime bacteria with spherical cysts
- Genus II. Myxococcus Thaxter, 1892. Slime bacteria with ovoid spores
- Genus III. Chondrococcus Jahn, 1924. Slime bacteria with slime spores

Order IV. FERRIBACTERIALES Krassilnikov, 1949--IRON BACTERIA

Family I. FERRIBACTERIACEAE Krassilnikov, 1949--TRUE IRON BACTERIA
- Genus I. Gallionella Ehrenberg, 1838. Kidney-shaped iron bacteria
- Genus II. Siderococcus Dorff, 1934. Spherical iron bacteria
- Genus III. Sideromonas Cholodny, 1922. Oviform iron bacteria
- Genus IV. Siderobacterium[1] Naumann, 1921. Rod-shaped iron bacteria

Family II. FERRITRICHACEAE Tešić, 1956--FILAMENTOUS IRON BACTERIA
- Genus I. Sphaerotilus Kützing, 1833. Heterotrophic iron bacteria
- Genus II. Leptothrix Kützing, 1833. Iron bacteria with motile gonidia
- Genus III. Crenothrix Cohn, 1870. Iron bacteria with non-motile gonidia

Order V. THIOBACTERIALES Buchanan, 1917--SULFUR BACTERIA

Family I. THIOBACTERIACEAE Buchanan, 1917--TRUE SULFUR BACTERIA
- Genus I. Achromatium Schewiakoff, 1893. Colorless sulfur bacteria
- Genus II. Chromatium Perty, 1852. Colored sulfur bacteria

[1] Editorial Note. The generic name proposed by Naumann was Siderobacter, not Siderobacterium. The latter is a nomen novum.

Genus III. Rhabdomonas Cohn, 1875. Purple sulfur bacteria
Genus IV. Thiospirillum Winogradsky, 1888. Spiral sulfur bacteria

Family II. THIOTRICHACEAE Pringsheim, 1949--FILAMENTOUS SULFUR BACTERIA
Genus I. Beggiatoa Trevisan, 1842. Filaments not in bundles
Genus II. Thioploca Lauterborn, 1907. Filaments in bundles
Genus III. Thiothrix Winogradsky, 1888. Filaments attached

Order VI. SPIROCHAETALES Buchanan, 1918--SPIROCHETES

Family I. SPIROCHAETACEAE Swellengrebel, 1907--SPIROCHETES
Genus I. Spirochaeta Ehrenberg, 1838. Saprophytic spirochetes

DISCUSSION

The first differences between the classification of Krassilnikov and that of ours lies in the fact that we regard the bacteria as constituting a class, in conformity with the ideas of the majority of microbiologists in the world. The Soviet author has introduced higher categories of taxa. We have omitted his special classes of these microorganisms, retaining the orders, families and genera. Further we have disagreed with the Soviet author who places all non-motile bacteria in the class of Actinomycetes, and have retained them in the order of the true bacteria, as have many other microbiologists. Further, we have omitted some of the members of the sulfur bacteria as of minor significance, but here also we have proposed a new system of classification, even though it is recognized as being of an "artificial" character. Finally, with the names of certain genera within a family, we have endeavored to get them nearer to the name of the type genus, hence we have chosen to use the names of genera

already known, recognizing that these are usually the genera based upon "physiological" characters. We justify this on the basis of didactic utility.

In certain families we have made some important changes. We have restored the genus Corynebacterium to the family Mycobacteriaceae in contrast to Krassilnikov. In place of his name Pseudobacterium we have restored the older well known name Aplanobacterium. In the family Pseudomonadaceae we introduced the new name Chromopseudomonas for a genus to include all pigmented bacteria with polar flagella, in order to do away with a multiplicity of names (such as Xanthomonas etc.). We have also recognized the name Rhizomonas even though it is a homonym of a genus of Flagellata, for this there is other precedent in contemporary microbiology. On account of the didactic reasons already mentioned we have transmuted certain generic names in order to facilitate grammatical usage (e.g. Azotobacter--Azotobacterium; Aplanobacter--Aplanobacterium; Nitrobacter--Nitrobacterium; Lactobacter--Lactobacterium; Siderobacter--Siderobacterium). In the family of Bacillaceae we have again introduced the genus Plectridium, which was discarded by Krassilnikov. In the iron bacteria we have proposed a new name of the family Ferritrichaceae.

Finally, the author is aware that in this system of the classification of bacteria, he has also included several names for genera and families, which are not fully consistent with the rules of the Code of International Bacteriological Nomenclature. Thus he has retained the family Bacteriaceae and the genus Bacterium, in spite of the decision of the Congress at Rome that these names become nomina rejicienda, because, like so many other microbiologists in Europe and Russia, he holds a divergent opinion. In order to avoid misunderstanding about the grammatical gender, with the names of genera ending in -bacter, the author has used everywhere the names of genera ending in -bacterium, which is much simpler and more definite. The new name of genus Chromopseudomonas is given after the pattern of the name Chromobacterium Bergonzini, 1881, but in the sense of Topley and Wilson, 1936, so that bacteria of all shades of pigments could be included. The new name of the family Ferritrichaceae also does not have its corresponding genus, but this is not the only exception of this kind in modern classification of bacteria (e.g. Bergey's

Manual, 1957). And again, with the trend of making the names uniform, according to the type genus in the family, some later synonyms have been taken, which would in any case, according to the above mentioned rules, be the "later illegitimate synonyms".

Hence, the author trusts that the suggested system of classification, together with the nomenclature used, should usefully serve in teaching general, agricultural and technological bacteriology.

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ENTEROBACTERIACEAE RAHN 1937, AN ILLEGITIMATE NAME

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The status of the family name Enterobacteriaceae Rahn 1937 has been reviewed in connection with the "Status of the generic name Bacterium, the specific name Bacterium coli, and the family name Bacteriaceae" (1). This statement (pp. 75-78) indicates that the generic name Enterobacter and the family name Enterobacteriaceae are invalid and without standing in nomenclature. The statement continues: "If the family name Bacteriaceae is rejected, it would seem desirable that the status of the family name Enterobacteriaceae be fixed by international agreement, and the type genus definitely designated." In this connection the statement mentions that at the Fifth Congress of Microbiologists in Rio de Janeiro, approval was given to the validation of family names which are not derived from names of the contained genera, providing that there is international agreement.

The generic name Enterobacter Rahn 1937 has been accepted and used by no other author to the best of my knowledge. However, the family name Enterobacteriaceae Rahn 1937 was used in Bergey's Manual of Determinative Bacteriology, 5th and 6th editions (1939 and 1948)[1]. It is to be regretted that some bacteriologists have followed this unfortunate example; moreover, a nomenclatural subcommittee of the International Committee on Bacteriological Nomenclature uses this family name in designation of its own name and for characterizing the special group of bacteria with which it works.

In 1939 the Code of Botanical Nomenclature (3rd Ed., 1935) served as a basis for the nomenclature of bacteria. Its Article 23 prescribes: "Names of families are taken from their present or former genera and end in -aceae." The acceptance of Rahn's family name without mentioning a genus Enterobacter completely disregarded the rules governing the bacterial nomenclature at that time.

[1] Editorial Note. The family name Enterobacteriaceae will be used also in the 7th edition (1957) of the Bergey's Manual.

In 1953 the generic name Bacterium as well as the family name Bacteriaceae were rejected (International Congress of Microbiologists in Rome), so that the case for a proposal of conserving the invalid name Enterobacteriaceae 1937 may now arise.

To ask microbiologists to agree to the conservation of a name which has been introduced and used in contravention to the internationally approved rules, might well undermine the fundamentals of the bacterial nomenclature. This would seem to constitute a precedent such that any name of a taxon may be validated, if only a bacteriologist accepts the name in a textbook. We are confronted by a rather serious situation; it is possible that such a proposal might open the way for common disregard of the rules.

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POLYANGIUM VITELLINUM LINK 1809

R. E. Buchanan

All of the species of bacteria described and named before 1800 were regarded by their authors as protozoa. Several of the species described by Mueller were undoubtedly bacteria, but none are now known by the names he proposed. Two of his species were named Vibrio undula and Vibrio spirillum, but are now known as Spirillum undula and S. volutans, renamed by Ehrenberg in 1832. However, the latter author also included them among the protozoa.

Apparently the first species belonging to the bacteria and described as a plant is Polyangium vitellinum Link (1809) (1). As the oldest name applied to one of the bacteria, it is of considerable historic interest. Inasmuch as the original descriptions are often not easily accessible, it has been thought worth while to review the history of this interesting organism.

In the year 1809 Heinrich Friedrich Link, Professor in the University of Rostock, published a paper on "Observations on the Natural Orders of Plants, First Dissertation: including the Epiphytae, Mucedines, Gastromyci and Fungi." Under Fungi he describes 26 genera, with an appendix including three others. In this appendix as the second genus he describes Polyangium and the species P. vitellinum. The text of his paper is reproduced on page 130.

This minute organism was placed among the fungi. The egg-yolk-like sporangioles within the transparent sporangium bore some resemblance to one of the bird-nest fungi among the gasteromycetes. The contents of the sporangioles were not resolved by the microscope. There is no reference in the text to an illustration or drawing. An earlier paragraph describing the genus Sporidesmium has inserted in ink, in the volume consulted as reference, to a Figure 64. There is a Figure 65 without a legend which undoubtedly is a figure of Polyangium vitellinum; it has been so regarded by subsequent authors. The figure is here reproduced on page 130.

Inter Gastromycos ante Endogonen inserē:

Polyangium. Sporangium globosum et oblongum læve. Sporangiola ratione sporangii maxima, oblonga, massa grumosa referta.

Sporangium constituitur e membrana tenui, vesiculose gelatinosa, pellucida, complectente sporangiola 4-6 oblonga, massa grumosa colorata referta. Sporidia non vidimus.

P. vitellinum, minutum sparsum colore vitellino sub hoc ordine inter minutissimos referendum. Magnitudine grani sabuli majoris in truncis siccis dispersum aut solitarium, aut duobus tribusve aggregatis appareret, colore tantum obscuro vitellino agnoscendum. Invenit am. Ditmar.

Reproduction of Link's original description of the genus Polyangium and the species Polyangium vitellinum (1809).

Fig. 1. Polyangium vitellinum. Reproduction of Fig. 65 from Link's description (1809).

The next reference to Polyangium vitellinum is a description by Ditmar (1813) (2). The page of description is here reproduced as well as his figure (pp. 132 and 133).

The description given by Ditmar is clearer. The illustration in the original paper is apparently hand colored. The organism is described as very small, scarcely visible to the naked eye. Sporangia are single, occasionally three or four together. The sporangioles are readily visible through the parchment-like transparent membrane of the sporangium. The sporangium is spherical or ovoid, light citron yellow in color. Each sporangium contains 3 to 6 almost orange sporangioles filled with a somewhat granular mass but without definite "sporidia". The organism is found on decaying wood in swampy places in late summer and autumn.

Schroeter (1889) (3) described Cystobacter as a new genus of bacteria (in the order Eubacteria). His diagnosis of the genus bears some resemblance to that of Polyangium. It reads: Cystobacter n. g. Zellen in Form kurzer dünner Stäbchen, in eine verbreitete Schleimmasse eingebettet, später in längeren Fäden zusammenhängend. Die Schleimmasse theilt sich in unregelmässige rundliche Klumpen, welche sich später mit einer festen hornartigen structurlosen Hülle umgeben.

However, Thaxter (1892, p. 394) (4) states that "The species of Cystobacter Schröter seems with little doubt to belong to the present family, and should be referred to Chondromyces."

Thaxter (1892) in his paper on the new order of bacteria, the Myxobacteriales, included a description of a new genus and new species as follows:

Myxobacter n. gen. Rods forming large rounded cysts, one or more free within a gelatinous matrix raised above the substratum. Myxobacter aureus n. sp. Plate XXV, Fig. 34-36. Colonies when rising to form cysts milky white. Rods large, cylindrical, rounded at either end, 4-7 x .7-.9 μ. Cysts spherical or oblong, golden yellow, thick walled, one to twelve or more in number, distinct within a hyaline matrix,

— 55 —

POLYANGIUM vitellinum. Link.

Gelbe Polyangie.

Tab. 27.

Minutum, sparsum, sporangio citrino, sporangiolis oviformibus subaurantiacis.

Klein, zerstreut wachsend, mit einer zitrongelben Sporangie und eyartigen fast orangefarbigen Sporangiolen.

Link Observat. in Ordin. plant. natur. Diss. I. p. 40. tab. 2. fig. 65.

Dieser Pilz ist sehr klein, so daß man ihn kaum mit bloßen Augen bemerken kann, und wächst fast immer einzeln, hin und wieder jedoch drey bis vier zusammen. Die Sporangie besteht aus einer dünnen, pergamentartigen und stark durchscheinenden Haut, so daß man die Sporangiolen deutlich darinn wahrnehmen kann, ist kugelförmig oder eyartig, an der Basis etwas flach, und von einer hellcitronengelben Farbe. Jede Sporangie schließt 3 bis 6 eyartige fast orangefarbigen Sporangiolen ein, welche eine grumöse etwas körnige Masse, wie die Aegeriten enthalten und durchaus keine deutliche Sporidien zeigen.

Auf verfaulten Holz an sumpfigen Orten ist dieser Pilz gegen Ende Sommers und im Herbste keine Seltenheit.

Reproduction of Ditmar's 1813 description of Polyangium vitellinum Link.

Fig. a. Die gelbe Polyangie in natürlicher Größe. B. Dieſelbe ſtark vergrößert. C. Die Sporangiolen derſelben, ebenfalls ſtark vergrößert.

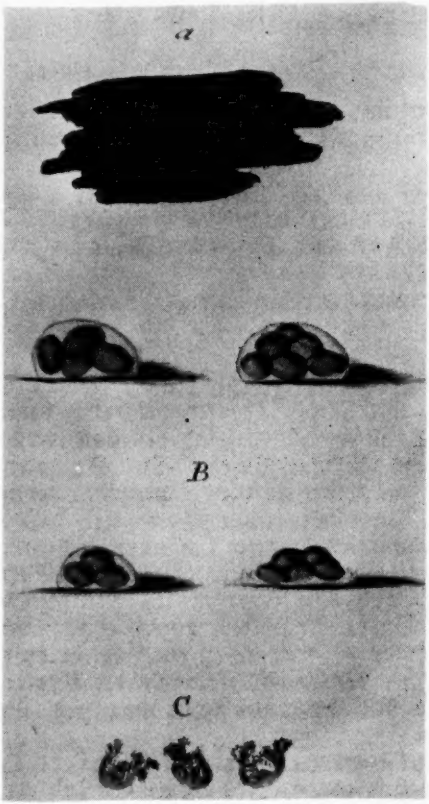

Fig. 2. Polyangium vitellinum. Reproduction of Ditmar's Figs. A, B and C.

75-350 x 75-275 μ. The encysted rods mingled with a yellow, oily material. Cyst groups .7-1 mm long.

On very wet wood and bark in swamps.

The Figures 34, 35 and 36 are herewith reproduced[1]. The resemblance of Thaxter's description and illustration to Polyangium vitellinum are striking.

Zukal (1897)(5) called attention to the identity of Thaxter's species Myxobacter aureus with Link's Polyangium vitellinum.

Thaxter (1904, p. 406) (6) later accepted Zukal's emendation and quoted him to the effect that P. vitellinum had at various times been looked upon as a gasteromycete, a myxomycete and even as an insect egg.

Polyangium vitellinum has had an interesting history. At first placed among the fungi (the puff balls), it was finally recognized as a species belonging in the slime bacteria. It has the oldest valid name of any of the bacteria now recognized.

REFERENCES

1. Link, H. F. 1809. Observationes in Ordines plantarum naturales. Dissertation I. Complectens Anandrarum ordines Epiphytas, mucedines, Gastromycos et Fungos. Der Gesellschaft naturforschender Freunde zu Berlin MAGAZIN für die die neuesten Entdeckungen in der gesammte Naturkunde. 3:3-42. Plates I and II. Figs. 1-65.
2. Ditmar, L. P. F. 1813. Die Pilze Deutschlands, in Sturm, Jacob. Deutschlands Flora in Abbildungen nach der Natur mit Beschreibungen 3:55-56. Plate 27.

[1]Reproduction of Figures 34, 35 and 36 of Plate XXV from Thaxter in the Botanical Gazette, Volume 17, pp. 389-406, 1892, is by permission of the publishers, The University of Chicago Press.

Plate XXV.

Myxobacter aureus n. sp.

Fig. 34. General habit showing four cysts embedded in gelatinous matrix. Fig. 35. Rods (living) from rising rod-mass. Fig. 36. Rods from cysts crushed at maturity.

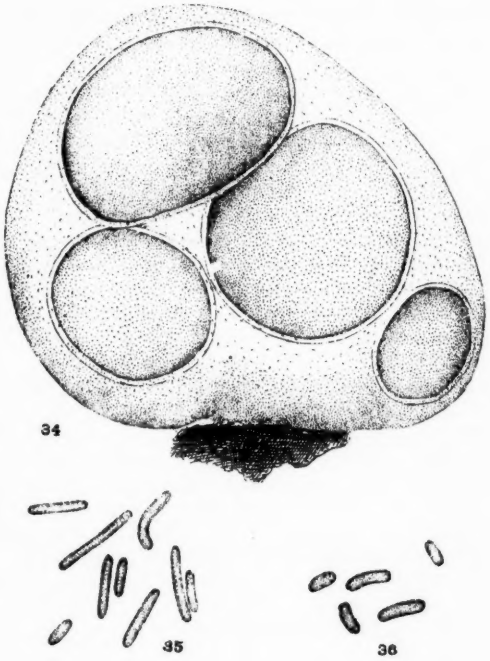

Fig. 2. Thaxter's illustrations of Polyangium vitellinum Link (Myxobacter aureus Thaxter).

3. Schroeter, J. 1889. Die Pilze Schlesiens, Erste Hälfte. In Cohn, Ferdinand. 1889. Kryptogamen-Flora von Shlesien. Erste Hälfte Pilze. 3:170
4. Thaxter, Roland. 1892. On the Myxobacteriaceae, a new order of Schizomycetes. Bot. Gaz. 17:389-406.
5. Zukal, Hugo. 1897. Ueber die Myxobacterien. Ber. d. Deutschen Bot. Gesellsch. 15:550.
6. Thaxter, Roland. 1904. Notes on the Myxobacteriaceae 37:405-416. Plates XXVI and XXVII.

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NOMENCLATURE AND TAXONOMY
Volume 7 No. 3 July 15, 1957 pp. 137-141

LETTERS TO THE EDITOR

To the Editor:

Your article on a wanted word has been read with interest. You wish a name to replace the long name of the journal, INTERNATIONAL BULLETIN OF BACTERIOLOGICAL NOMENCLATURE AND TAXONOMY. May I be allowed to make some suggestions?

First: I think Onomatotaxy and Onomatotaxology should be discarded for the following reasons:

a. The names are long.

b. They are difficult to pronounce for people not speaking English. (I think that Onomatotaxology is a "hard nut to crack" even for one who speaks academic English.)

c. Very few microbiologists would know immediately what the words mean.

Second: I believe it unnecessary to tell readers that our journal also contains articles on nomenclature. Nomenclature is an important help to the taxonomist and everybody will agree that a journal on taxonomy should also contain articles in this field.

Third: I would prefer a very short name (ars longa, vita brevis).

May I suggest the following three names:

1. Cohnia in honour of the founder of modern systematic bacteriology, Ferdinand Cohn.
2. Systematic Bacteriology (or Microbiology).
3. Microtaxon, i.e. Taxon of Microorganisms.

N. Fabritius Buchwald,
Copenhagen.

To the Editor:

I am in receipt of a letter from Dr. Pirie of the Rothamsted Experiment Station at Harpenden, Herts, in which he makes two constructive suggestions relative to a new name for the BULLETIN. In substance his suggestions and proposals are as follows.

If a new word is coined, it "should either have a fairly evident meaning or else it should leave the person who sees it for the first time quite sure that he does not know what it means and so force him to find out." A phrase such as Bacterial Onomatotaxy includes a new word which may be misinterpreted.

Further, "there is no problem about classifying or arranging words, an alphabetical index is fine. The problem we are up against always is the arrangement of things, ideas or concepts. To an antimetaphysician like me that is the important thing to get across in a new word."

Dr. Pirie regards the introduction of words ending in -taxy as not entirely appropriate, for the verb from which it is derived, τάσσω, "means to arrange an army and seems much more to imply ranking than arrangement." He much prefers that a word be derived from the Greek verb διατίθημι which "means to arrange the wares in a shop or to arrange ones property in a will, and that is more nearly what we are after. So Diatithetics might do. Certainly few people would have illusions about its meaning."

Dr. Pirie believes that much may be said for words which end in -ology. In the context one might coin a word meaning a science of things or a word meaning a science of concepts. The Greek noun πραγμα (thing) would give Pragmatology, "but the special meaning of pragmatic might be confusing." Why not derive a word from the present participle of the Greek verb νοεῖν (νοέω) (to conceive), the noumenon of Kant (as opposed to phenomenon) and get Noumenology, science of concepts. "What, in spite of the title of your institute, we are concerned with is the naming and classification of somewhat idealized concepts of bacteria rather than the simple matching with a type." He notes that this proposed word seems not to have been used previously, and that it is

euphonious. In summary he proposes two new names for consideration, Bacteriological Diatithetics and Microbiological Noumenology.

Personally I prefer "diatithetics" to "noumenology". The only disadvantage of "diatithetics" is the confusion there might be between it and "dietetics".

S. T. Cowan,
London.

To the Editor:

In a recent paper, Hormaeche and Munilla (Biochemical tests for the differentiation of Klebsiella and Cloaca, Internatl. Bull. Bact. Nomen. and Taxon. 7:19. 1957.) state:

> "We favour the suggestion of Edwards that the name Aerobacter should be chosen for the motile group; this would need redefinition of the genus because the type species A. aerogenes disappears from it."

This statement warrants two comments.

First, it is implied that a generic name of a genus can be maintained if the type species is removed from that genus. This is clearly contrary to the type concept, now incorporated into all of the biological codes of nomenclature, bacteriological, botanical and zoological. A genus may be widened or narrowed depending upon the judgment of the writer but it must contain the type species; this is clearly stated in the rules. Aerobacter may be retained as a generic name for a genus which must contain the species Aerobacter aerogenes. The definition of the type species Aerobacter aerogenes may be narrow or wide as long as it contains the type (culture) of the species. Unfortunately in this case no type culture has been designated.

Second, the original description of Aerobacter aerogenes did not define the species as nonmotile. Beijerinck's words (Centrb. Bakt. II 6:193. 1900.) were:

"Bewegung wird oft beobachtet, kann aber fehlen. Bei A. aërogenes sind die Cilien über die ganze Oberfläche verteilt (peritrich), bei A. liquefaciens kommt nur eine polare Cilie vor (monotrich)."

A. aerogenes thus may be retained within a motile group. The definition of Aerobacter may be extended, if it is desired, to include monotrichic strains, and it may be narrowed to remove the nonmotile strains to another species or genus. But Aerobacter aerogenes must remain in the genus Aerobacter, if this generic name is to be retained.

Therefore, it would seem that Hormaeche and Munilla are free, under the rules, to make the changes they suggest; changes which, incidentally, the author does not wish to approve or to disapprove in any way. It would seem preferable to put both motile and nonmotile species in one genus, which apparently would be Klebsiella. In several groups, motility is not a good taxonomic criterion. Rather than maintaining two genera, Klebsiella typified by the nonmotile K. pneumoniae and Aerobacter typified by the motile Aerobacter aerogenes based on a questionable taxonomic criterion, might it not be more realistic to recognize only the one genus, Klebsiella, containing all the species? And Cloaca is not a well chosen generic name, regardless of its legality. The cloaca is where many of us feel tempted at times to consign all troublesome taxonomic problems.

C. E. Skinner,
Department of Bacteriology and
Public Health,
State College of Washington,
Pullman, Washington, U.S.A.

To the Editor:

In 1935 a classification of a bacterial group very similar to the Enterobacteriaceae Rahn 1937 used in Bergey's Manual (editions 5 and 6) was published by Haupt (Ergebn. d. Hyg., Bakt., Imm.-forschg. und exp. Ther. B. 17, S. 175-230: "Zur Systematik der Bakterien. Die für Mensch und Tier

pathogenen gramnegativen, alkalibildenden Stäbchenbakterien (=Aerobactereae Pribram 1929 em.)"). The tribus Aerobactereae is divided into

Subtribus I: Cloacinae Haupt 1935, with genera
Cloaca Cast. et Chalm. 1919
Proteus Hauser 1885
Bookeria Haupt 1935

Subtribus II: Alcaligeninae Haupt 1935, with genera
Alcaligenes Cast. et Chalm. 1919
Brucella K. F. Meyer et E. B. Shaw 1920

Subtribus III: Aerobacterinae Haupt 1935, with genera
Klebsiella Trevisan 1885
Aerobacter Beijerinck 1900
Escherichia Cast. et Chalm. 1919

Subtribus IV: Salmonellinae Haupt 1935, with genera
Salmonella Lignieres 1900 em. White 1929
Shigella Cast. et Chalm. 1919

Haupt's subtribes III and IV are identical with the tribes I and V of the family Enterobacteriaceae Rahn 1937, as contained in Bergey's Manual (6th edition). Subtribes instead of tribes had to be chosen, because besides the tribus Aerobactereae provision was made for another tribus Pasteurelleae, both being united in a family Aerobacteraceae. While the tribus Aerobactereae was elaborated to include the species (with descriptions, keys and nomenclatural types), in the tribus Pasteurelleae only the genera (with their type species) and the species contained in, or attached to them, are named. This tribus has not been elaborated as yet; it includes the general Hemophilus, Pasteurella and Actinobacillus.

H. Haupt,
Department of Veterinary Hygiene,
University of Giessen,
Giessen, West Germany.

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Volume 7 No. 3 July 15, 1957 pp. 143-145

NOMENCLATURAL REVIEW

Krassilnikov, N. A. Guide to the identification of the bacteria and Actinomycetes. (Section pertaining to Actinomycetes) Academy of Sciences, U.S.S.R. Moscow, 1949. Translation of section pertaining to Actinomycetes, edited by John B. Routien, Charles Pfizer and Co., Inc. 1957.

Dr. Routien and the Pfizer Company deserve the thanks of bacteriologists generally for this "offset" translation of the text on the Actinomycetes from Krassilnikov's original Russian.

Krassilnikov divides the Protophyta of Sachs into two groups:

I. Schizophyceae. These are organisms which form chlorophyll, phycocyanin, and phycoerythrin; they photosynthesize organic substances and liberate oxygen upon assimilation of carbon dioxide.

II. Schizomyceae. Nonchlorophyll-bearing organisms which contain neither phycocyanin nor phycoerythrin; they are colorless or colored but the pigments do not have photosynthetic properties; a basic majority of them are heterotrophic. Four classes are recognized:

1. Class Actinomycetes.
2. Class Eubacteriae.
3. Class Myxobacteriae.
4. Class Spirochaetae.

He also recognizes, in a supplement, an Order Chlamydozoa to include organisms which do not have a precise systematic position. He defines this order as "extreme minute or ultramicroscopic organisms, not visible with the ordinary optical microscope; they appear in the form of elementary corpuscles only after treatment by special methods. Rigid cytotropes inhabit the living cells. Their nature has not yet been studied. It is not known whether they are representative of bacteria, actinomycetes, fungi or protozoa."

The Class Actinomycetes, Krassilnikov, 1945 is subdivided into three orders:

1. Order Actinomycetales. Organisms with a well-developed mycelium. On the branches of the mycelium there is formation of organs of fertility, i.e. spores.

2. Order Mycobacteriales. Bacillary, Gram-positive cells; well-developed branching in the typical forms; in the process of development, the cells are transformed into coccoid forms. In the degenerated coccoid forms (mycococci), lateral protuberances, which are the rudiments of branches, may be observed.

3. Order Coccaceae. Typical coccoid organisms without any protuberances whatever.

The Order Actinomycetales is divided into two families:

1. Family Actinomycetaceae. Well-defined mycelium or promycelium. The typical examples have multiple spores distributed in chains on the aerial branches of the mycelium.

2. Family Micromonosporaceae. Single spores, attached individually on the branches of the mycelium.

The Family Actinomycetaceae includes two genera:

1. Genus Actinomyces. Cultures with a well-developed, nonseptate mycelium.

2. Genus Proactinomyces. The cultures form a mycelium which is septate and readily fragments into bacilli and cocci.

A key is given for identifying the 53 species of the genus Actinomyces. There is also a key for the differentiation of the 19 varieties of the species A. albus recognized, and for the 13 varieties of A. flavus.

The reader is subjected to some nomenclatural confusion by the fact that in genus Actinomyces four species are recognized with illegitimate specific epithets; namely, A. viola-

ceus niger, A. longisporus ruber, A. longisporus flavus, and A. reticulus ruber. These epithets are illegitimate because there is lack of conformity with the binomial system of nomenclature for species. The species A. micetomae might better have been transliterated from the Greek as mycetomatis.

The reader may also be confused by the fact that rather consistently Krassilnikov uses binomials in the naming of subspecies, particularly in those cases in which the species of other authors are reduced to subspecific rank.

The genus Proactinomyces includes 33 species with a key.

The family Micromonosporaceae includes the single genus Micromonospora with 9 species appearing in the key.

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NEWS AND NOTES

RESIGNATION OF PROFESSOR WIKÉN AS PERMANENT SECRETARY. Professor Torsten Wikén under date of April 1, 1957, tendered his resignation as Joint Permanent Secretary of the International Committee on Bacteriological Nomenclature. Professor Wikén has accepted the post in Microbiology long held by Professor A. J. Kluyver at the Technological University at Delft, The Netherlands. Dr. Wikén has served as the permanent secretary for nonmedical bacteriology since the resignation of Professor R. S. Breed.

In a letter to the Editor, Professor Wikén states:

"Tomorrow, April 1st, 1957, I will leave Zürich, Switzerland, for Delft, Holland..... At Delft I will take over a very big new institute that will be finished at the end of this year or in the beginning of next year. I will from now on have much more to do with research and administration than I had here at Zürich.

The above means that I have to retire from the secretaryship as soon as possible so there will be plenty of time to find a new man who can take over the job."

Dr. Cowan under the provisions of the rules of the International Committee on Bacteriological Nomenclature is securing nominations for a nonmedical secretary pro tem, to be elected by the Judicial Commission. He will serve until the meeting of the International Committee at Stockholm in 1958, under the chairmanship of Dr. E. G. D. Murray, when a permanent joint secretary will be chosen.

SUBVENTIONS FROM UNESCO THROUGH THE INTERNATIONAL UNION OF BIOLOGICAL SOCIETIES TO TYPE CULTURE COLLECTIONS. The United Nations Educational, Scientific, and Cultural Organization (UNESCO) for the past several years has granted subventions to type culture collections in various countries, recently by allocation through the International Union of Biological Societies (IUBS). At the time of the Rome International Congress of Microbiology (1953), the International Association of Microbiological Societies (IAMS) asked that

the allocations to type culture collections be made upon recommendation of the IAMS. This proposal was agreed to by IUBS, and a special committee of IAMS was appointed (Dr. Stuart Mudd, Philadelphia, Chairman) to recommend to the Executive Committee of IAMS the amounts of the several allocations.

The IUBS (Rome 1955) approved the following resolutions:

"1. That the available funds should be allocated by the Executive Committee of IAMS, which in this way would be acting as a Section of the IUBS.

2. That in the first place support should be given to private collections of microorganisms of special interest, that are not handled by the larger collections, especially collections that do not support themselves by the sale of their cultures; and in second place, support should be given to the International Centre at Lausanne, to further its work as an information centre about all culture collections throughout the world."

Dr. Giuseppe Penso, Secretary-General of the IAMS has proposed that notice of the availability of funds to suitable culture collections be announced by publication in appropriate journals of a statement outlining the procedure to be followed by culture collections meeting the provisions of the IUBS directive as noted above. Dr. Penso has proposed the following statement:

"The type culture collections of microorganisms which are interested in receiving funds from the IUBS should make application specifying their needs, to the Secretary of the IAMS, Professor G. Penso, Istituto Superiore di Sanita, Roma, Italy."

It is urged that applications be made promptly.

Errata: Vol. 7, No. 1, p. 7.

Errata: Vol. 7, No. 1, p. 7.
IMVIC signs inadvertently
omitted from Table 1.

Table 1. The 72 Klebsiella capsulated strains from type culture collections.

	Gas from cellobiose								Acid from cellobiose		
Group	1	2	3	4	5	6	7	8	1	3	4
IMViC	- - + +	- + + +	- + - -	- + - +	- - - +	+ - + +	+ + - +	+ + + +	- - + +	- + - -	- + - +
No. of strains	53	5	1	1	1	4	1	3	1	1	1
Dulcitol	Gas:17 Neg:36	Gas:1 Neg:4	Neg.	Neg.	Neg.	Gas:1 Neg:2 Ac: 1	Neg.	Gas:2 Neg:1	Neg.	Neg.	Neg.
Adonitol	Neg: 8 Gas:45	Gas:5	Gas	Gas	Gas	Gas:4	Gas	Gas:3	Acid	Acid	Acid
Inositol	Ac: 1 Gas:52	Gas:5	Gas	Gas	Gas	Gas:4	Gas	Gas:3	Acid	Acid	Acid
Aesculin	Neg: 1 Pos:52	Neg:1 Pos:4	Pos.	Pos.	Pos.	Neg:1 Pos:3	Pos.	Pos:3	Neg.	Pos.	Pos.
Starch	Gas:53	Gas:5	Gas	Neg.	Gas	Gas:4	Gas	Gas:3	Acid	Acid	Acid
Dextrin	Ac: 2 Gas:51	Gas:5	Gas	Acid	Gas	Ac: 1 Gas:3	Gas	Gas:3	Acid	Acid	Acid
Glycerol	Gas:53	Gas:5	Gas	Gas	Gas	Gas:4	Gas	Gas:3	Acid	Acid	Acid
Urea (slow)	Pos:49 Neg: 4	Pos:2 Neg:3	Neg.	Neg.	Pos.	Pos:4	Pos.	Pos:3	Pos.	Neg.	Pos.
Urea (quick)	Pos:50 Neg: 3	Pos:2 Neg:3	Neg.	Neg.	Pos.	Pos:4	Pos.	Pos:3	Pos.	Neg.	Neg.
Gelatine	Pos: 3 Neg:50	Neg:5	Pos.	Neg.	Pos.	Pos:3 Neg:1	Neg.	Neg:3	Neg.	Neg.	Neg.
KCN	Pos:52 Neg: 1	Pos:5	Pos.	Pos.	Pos.	Pos:4	Pos.	Pos:3	Pos.	Weak Pos.	Weak Pos.
Arginine	Neg:53	Neg:5	Neg.	Pos.	Neg.	Neg:4	Neg.	Neg:3	Neg.	Neg.	Neg.

Errata: Vol. 7, No. 1, p. 9.
IMVIC signs inadvertently

Table 2. The 286 Klebsiella isolated strains. All produce gas from cellobiose.

Errata: Vol. 7, No. 1, p. 9. IMVIC signs inadvertently omitted from Table 2.

Table 2. The 286 *Klebsiella* isolated strains. All produce gas from cellobiose.

Group	1	2	4	5	6	7	8	9
IMViC	- - + +	- + + +	- + - +	- - - +	+ - + +	+ + - +	+ + + +	- + + -
No. of strains	198	16	14	12	32	2	11	1
Dulcitol	Ac: 1 Gas:67 Neg:130	Gas:2 Neg:14	Gas:6 Neg:8	Gas:4 Neg:8	Gas:16 Neg:16	Neg:2	Gas:4 Neg:7	Gas
Adonitol	Ac: 1 Gas:157 Neg:40	Gas:14 Neg: 2	Gas:13 Neg: 1	Gas:12	Gas:32	Gas:2	Gas:11	Gas
Inositol	Ac: 4 Gas:193 Neg:1	Gas:16	Gas:13 Neg:1	Gas:12	Gas:32	Gas:2	Gas:10 Ac: 1	Gas
Aesculin	Pos:197 Neg:1	Pos:16	Pos:14	Pos:12	Pos:32	Pos:2	Pos:11	Pos.
Starch	Ac: 2 Gas:196	Ac: 1 Gas:15	Gas:14	Gas:12	Gas:32	Gas:2	Gas:11	Gas
Dextrin	Ac: 9 Gas:189	Gas:15 Neg:1	Gas:14	Gas:12	Ac: 2 Gas:29 Neg:1	Gas:2	Ac: 2 Gas:9	Gas
Glycerol	Gas:198	Gas:16	Gas:14	Gas:12	Gas:32	Gas:2	Gas:11	Gas
Urea (slow)	Neg:8 Pos:190	Pos:16	Pos:14	Pos:12	Neg:3 Pos:29	Pos:2	Pos:11	Pos.
Urea (quick)	Neg:3 Pos:195	Pos:16	Pos:14	Pos:12	Neg:1 Pos:31	Pos:2	Pos:11	Pos.
Gelatin	Pos:29 Neg:169	Pos:5 Neg:11	Neg:14	Pos:2 Neg:10	Pos:27 Neg:5	Pos:1 Neg:1	Pos:6 Neg:5	Neg.
KCN	Pos:198	Pos:16	Pos:14	Pos:12	Neg:1 Pos:31	Pos:2	Neg:1 Pos:10	Pos.
Arginine	Pos:4 Neg:194	Neg:16	Neg:14	Neg:12	Neg:32	Neg:2	Neg:11	Neg.
Capsule	Pos:166 Neg:32	Pos:14 Neg:2	Pos:12 Neg:2	Pos:10 Neg:2	Pos:25 Neg:7	Pos:1 Neg:1	Pos:8 Neg:3	Neg.

IMVIC signs inadvertently omitted from Table 3.

Table 3. 202 Cloaca strains. All gas from cellobiose.

IMViC signs inadvertently omitted from Table 3.

Table 3. 202 *Cloaca* strains. All gas from cellobiose.

	177 motile forms					25 "O" forms			
Group	1	2	4	5	10	1	2	4	5
IMViC	- - + +	- + + +	- + - +	- - - +	- - + -	- - + +	- + + +	- + - +	- - - +
No. of strains	169	1	5	1	1	16	7	1	1
Dulcitol	Ac: 1 Gas:25 Neg:143	Neg.	Gas:2 Neg:3	Gas	Neg.	Gas:1 Neg:15	Ac: 1 Neg:6	Neg.	Neg.
Adonitol	Ac: 1 Gas:63 Neg:105	Neg.	Neg:4 Gas:1	Neg.	Neg.	Ac: 2 Neg:12 Gas:2	Neg:7	Neg.	Neg.
Inositol	Gas:27 Ac:71 Neg:71	Acid	Ac: 2 Neg:3	Acid	Gas	Gas:3 Ac:3 Neg:10	Ac: 1 Neg:6	Acid	Acid
Aesculin	Pos:55 Neg:114	Neg.	Pos:1 Neg:4	Pos.	Pos.	Pos:12 Neg:4	Pos:7	Pos.	Neg.
Starch	Gas:1 Ac: 49 Neg:119	Neg.	Ac: 1 Neg:4	Neg.	Acid	Ac: 2 Neg:14	Neg:7	Neg.	Acid
Dextrin	Gas:24 Ac:99 Neg:46	Gas	Gas:3 Neg:2	Neg.	Acid	Gas:1 Ac: 5 Neg:10	Ac: 3 Neg:4	Acid	Acid
Glycerol	Gas:27 Ac:62 Neg:80	Neg.	Ac:3 Neg:2	Acid	Gas	Gas:1 Ac: 11 Neg:4	Ac:7	Acid	Acid
Urea (slow)	Neg:169	Neg.	Neg:5	Neg.	Neg.	Neg:16	Neg:7	Neg.	Neg.
Urea (quick)	Neg:169	Neg.	Neg:5	Neg.	Neg.	Neg:16	Neg:7	Neg.	Neg.
Gelatin	Pos:154 Neg:15	Pos.	Pos:4 Neg:1	Pos.	Neg.	Pos:14 Neg:2	Pos:6 Neg:1	Pos.	Pos.
KCN	Neg:2 Pos:167	Pos.	Pos:5	Pos.	Pos.	Pos:16	Pos:7	Pos.	Pos.
Arginine	Pos:146 Neg:23	Pos.	Pos:4 Neg:1	Pos.	Neg.	Pos:14 Neg:2	Pos:4 Neg:3	Neg.	Pos.
Capsule	Pos:15 Neg:154	Pos.	Neg:5	Neg.	Neg.	Pos:1 Neg:15	Pos:1 Neg:6	Neg.	Neg.

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ERRATA

A Taxonomic Study of the Genus Spirillum Ehrenberg

Marion A. Williams and S. C. Rittenberg

Volume 7, No. 2, April 15, 1957, pp. 49-111

Substitute S. anulus for S. undula in the following:

Page 56	Line 6	Table 1
Page 62	Line 6	Table 2
Page 65	Line 25	
Page 65	Line 28	
Page 66	Line 10	
Page 66	Line 20	
Page 72	Line 27	
Page 106	Line 1	Figure 8
Page 108	Line 21	Figure 23
Page 110	Line 9	Figure 30